

Translation

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY  
(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference <b>B03/0453PC</b>	FOR FURTHER ACTION	See Form PCT/IPEA/416
International application No. <b>PCT/EP2004/008192</b>	International filing date (day/month/year) <b>22.07.2004</b>	Priority date (day/month/year) <b>24.07.2003</b>
International Patent Classification (IPC) or national classification and IPC <b>C07C7/08, C07C11/16</b>		
Applicant <b>BASF AKTIENGESELLSCHAFT</b>		

<p>1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.</p> <p>2. This REPORT consists of a total of <u>5</u> sheets, including this cover sheet.</p> <p>3. This report is also accompanied by ANNEXES, comprising:</p> <p>a. <input type="checkbox"/> (sent to the applicant and to the International Bureau) a total of _____ sheets, as follows:</p> <p><input type="checkbox"/> sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).</p> <p><input type="checkbox"/> sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.</p> <p>b. <input type="checkbox"/> (sent to the International Bureau only) a total of (indicate type and number of electronic carrier(s)) _____, containing a sequence listing and/or tables related thereto, in computer readable form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).</p>																									
<p>4. This report contains indications relating to the following items:</p> <table><tr><td><input checked="" type="checkbox"/></td><td>Box No. I</td><td>Basis of the report</td></tr><tr><td><input type="checkbox"/></td><td>Box No. II</td><td>Priority</td></tr><tr><td><input type="checkbox"/></td><td>Box No. III</td><td>Non-establishment of opinion with regard to novelty, inventive step and industrial applicability</td></tr><tr><td><input type="checkbox"/></td><td>Box No. IV</td><td>Lack of unity of invention</td></tr><tr><td><input checked="" type="checkbox"/></td><td>Box No. V</td><td>Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement</td></tr><tr><td><input type="checkbox"/></td><td>Box No. VI</td><td>Certain documents cited</td></tr><tr><td><input type="checkbox"/></td><td>Box No. VII</td><td>Certain defects in the international application</td></tr><tr><td><input type="checkbox"/></td><td>Box No. VIII</td><td>Certain observations on the international application</td></tr></table>		<input checked="" type="checkbox"/>	Box No. I	Basis of the report	<input type="checkbox"/>	Box No. II	Priority	<input type="checkbox"/>	Box No. III	Non-establishment of opinion with regard to novelty, inventive step and industrial applicability	<input type="checkbox"/>	Box No. IV	Lack of unity of invention	<input checked="" type="checkbox"/>	Box No. V	Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement	<input type="checkbox"/>	Box No. VI	Certain documents cited	<input type="checkbox"/>	Box No. VII	Certain defects in the international application	<input type="checkbox"/>	Box No. VIII	Certain observations on the international application
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Date of submission of the demand	Date of completion of this report																								
Name and mailing address of the IPEA/EP	Authorized officer																								
Facsimile No.	Telephone No.																								

## INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.

PCT/EP2004/008192

## Box No. I Basis of the report

1. With regard to the language, this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.
- ☐ This report is based on translations from the original language into the following language \_\_\_\_\_, which is the language of a translation furnished for the purposes of:
- ☐ international search (Rule 12.3 and 23.1(b))
- ☐ publication of the international application (Rule 12.4)
- ☐ international preliminary examination (Rule 55.2 and/or 55.3)
2. With regard to the elements of the international application, this report is based on (*replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report*):
- ☐ the international application as originally filed/furnished
- ☒ the description:
- pages 1-10 \_\_\_\_\_ as originally filed/furnished
- pages\* \_\_\_\_\_ received by this Authority on \_\_\_\_\_
- pages\* \_\_\_\_\_ received by this Authority on \_\_\_\_\_
- ☒ the claims:
- nos. 1-8 \_\_\_\_\_ as originally filed/furnished
- nos.\* \_\_\_\_\_ as amended (together with any statement) under Article 19
- nos.\* \_\_\_\_\_ received by this Authority on \_\_\_\_\_
- nos.\* \_\_\_\_\_ received by this Authority on \_\_\_\_\_
- ☒ the drawings:
- sheets 1/1 \_\_\_\_\_ as originally filed/furnished
- sheets\* \_\_\_\_\_ received by this Authority on \_\_\_\_\_
- sheets\* \_\_\_\_\_ received by this Authority on \_\_\_\_\_
- ☐ a sequence listing and/or any related table(s) – see Supplemental Box Relating to Sequence Listing.
3. ☐ The amendments have resulted in the cancellation of:
- ☐ the description, pages \_\_\_\_\_
- ☐ the claims, nos. \_\_\_\_\_
- ☐ the drawings, sheets/figs \_\_\_\_\_
- ☐ the sequence listing (*specify*): \_\_\_\_\_
- ☐ any table(s) related to sequence listing (*specify*): \_\_\_\_\_
4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).
- ☐ the description, pages \_\_\_\_\_
- ☐ the claims, nos. \_\_\_\_\_
- ☐ the drawings, sheets/figs \_\_\_\_\_
- ☐ the sequence listing (*specify*): \_\_\_\_\_
- ☐ any table(s) related to sequence listing (*specify*): \_\_\_\_\_

\* If item 4 applies, some or all of those sheets may be marked "superseded."

## INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.

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**Box No. V** Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

## 1. Statement

Novelty (N)	Claims	<u>1-8</u>	YES
	Claims		NO
Inventive step (IS)	Claims	<u>1-8</u>	YES
	Claims		NO
Industrial applicability (IA)	Claims	<u>1-8</u>	YES
	Claims		NO

## 2. Citations and explanations (Rule 70.7)

The application relates to a process for continuously separating a C<sub>4</sub> cut by extractive distillation with a selective solvent, the crude C<sub>4</sub> cut being supplied to a first extractive distillation column (K1) and a side stream in the vapour phase which contains C<sub>4</sub>-acetylenes, as well as 1,3-butadiene, 1,2-butadiene, C<sub>5</sub>-hydrocarbons and a selective solvent, is extracted from the column below the supply of crude C<sub>4</sub> cut, the concentration of C<sub>4</sub>-acetylenes in the side stream in the vapour phase lying below the spontaneous decomposition threshold of the same. Also extracted is a head stream which contains the crude C<sub>4</sub> cut components which are less soluble in the selective solvent than C<sub>4</sub>-acetylenes (claims 1-8).

**D1:** WO 2004 011 406 (P document)

**D2:** DE 100 22 465, cited in the application

**D3:** EP 0 284 971

1. Novelty - PCT Article 33(2)

**D1** discloses a process for continuously extracting crude 1,3-butadiene from a C<sub>4</sub> cut by extractive distillation with a selective solvent, butene and butane being

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extracted as two separate head streams, not in a common head stream as in the present application.

A process for continuously separating 1,3-butadiene is also known from **D2-D3**, in which the crude C<sub>4</sub> cut is supplied in the central region of the extractive distillation column, the solvent is supplied above the crude C<sub>4</sub> cut, and a side stream and head stream are extracted. In **D2**, additional selective hydrogenation on a heterogeneous catalyst is required. In **D3**, the crude 1,3-butadiene is purified in two interconnected distillation columns.

Since neither **D2** nor **D3** disclose front end acetylene precipitation, i.e. side stream (3), the subject matter of claim 1 is considered novel.

## 2. Inventive step - PCT Article 33(3)

**D2** is regarded as the closest prior art. The process as per claim 1 differs from **D2** in that it relates to front end acetylene precipitation, instead of heterogeneous catalytic selective hydrogenation. The object of the invention is to devise a simple and economic process for separating a C<sub>4</sub> cut by extractive distillation into separate 1,3-butadiene, butene and butane streams, thus reducing or eliminating the problems caused by acetylenes in thermal treatment processes. This object is attained by the process as per claim 1 in that acetylenes are separated during the C<sub>4</sub> cut extractive distillation process already, i.e. during the so-called front end process.

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Acetylenes are the main causes of machine fouling in C<sub>4</sub> cut thermal separation processes and are susceptible to spontaneous decomposition in wide concentration ranges. For this reason, their removal is critical. **D3** describes the processing of a C<sub>4</sub> cut by extractive distillation with a selective solvent, associated with distillative purification, the resultant crude 1,3-butadiene being distilled in two interconnected distillation columns. **D2** describes the processing of a C<sub>4</sub> cut by extractive distillation and heterogeneous catalytic selective hydrogenation, associated with distillative purification. Consequently, there is no indication in the prior art of acetylene front end precipitation in a process for separating a crude C<sub>4</sub> cut by extractive distillation with a selective solvent. The proposed solution avoids the need to carry out heterogeneous catalytic selective hydrogenation and its costly disadvantages (see page 3, lines 11-22, of the description). The claimed process therefore involves an inventive step.